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ABSTRACT

Scores from the October 1986 and March 1987 national administrations of the NTE Test of General Knowledge were analyzed to determine if area of undergraduate major was related to performance on the four sections of the test. To control for the range of skills associated with different reasons for taking the test, self-reported cumulative undergraduate grade point average was used as a covariate in the analyses. Results for both administrations supported the construct validity of the test. The highest scores on the literature and fine arts sections were achieved by humanities majors, social science majors achieved the highest scores on the social studies section, and natural science (including math, physical science, and geological science) majors achieved the highest scores on the math and science sections. Appendixes A and B provide analysis of variance and analysis of covariance summary tables. (Contains 7 tables.) (Author/SLD)

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THE RELATIONSHIP OF UNDERGRADUATE MAJOR TO GENERAL KNOWLEDGE SCORES

Gerald E. DeMauro

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Educational Testing Service
Princeton, New Jersey
March 1988

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THE RELATIONSHIP OF UNDERGRADUATE MAJOR TO GENERAL KNOWLEDGE SCORES

Gerald E. DeMauro
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ABSTRACT

Scores from the October 1986 and March 1987 national administrations of the NTE Test of General Knowledge were analyzed to determine if area of undergraduate major was related to performance on the four sections of the test. To control for the range of skills associated with different reasons for taking the test, self-reported cumulative undergraduate grade point average was used as a covariate in the analyses. Results for both administrations supported the construct validity of the test. The highest scores on the literature and fine arts sections were achieved by humanities majors, social science majors achieved the highest scores on the social studies section, and natural science (including math, physical science and geological science) majors achieved the highest scores on the math and science sections.

THE RELATIONSHIP OF UNDERGRADUATE MAJOR TO GENERAL KNOWLEDGE SCORES

The Core Battery of the National Teachers Examination comprises tests of Communication Skills, of General Knowledge, and of Professional Knowledge. The Test of General Knowledge is taken by examinees who are more varied in their educational backgrounds than the examinees who take either the Test of Communication Skills or the Test of Professional Knowledge. In some states, e.g., New Jersey and California, the Test is a certification requirement for teachers who were not education majors or who were not enrolled in state approved teacher preparation programs. As a consequence, many non-education majors also take the test as a requirement of varied "alternate route" programs.

The Test of General Knowledge has sections in literature and fine arts, social studies, mathematics, and science. One measure of construct validity of the instrument would be to demonstrate that examinees who have differential exposure to courses in these areas score differently. Since the undergraudate major of examinees is collected on the answer sheet, an analysis of differential scoring was conducted.

Sample

Scores from the October 1986 and March 1987 national administrations of the Core Battery were analyzed. Table 1 shows the categories of undergraduate majors that are collected on the answer sheets, as well as the specific majors within each category. Both first-time and retake examinees were included in the sample. Specific undergraduate majors cannot be separated from the broad categories shown in Table 1.

Hypotheses

1. Humanities majors would score highest in literature and fine arts;

Table 1

Undergraduate Major Fields as Listed
on the Answer Sheet

Code 01 - Humanities

Art History
Classics, Classical Language
Comparative Literature
Drama, Dramatic Arts
English Literature
Far Eastern Languages and Literature
Fine Arts, Art, Design
French
German
Italian
Linguistics
Modern Languages
Music
Near Eastern Languages and Literature
Other Foreign Languages
Other Humanities
Philosophy
Religion, Religious Studies
Russian
Spanish
Speech

Code 02 - Natural Sciences

Anatomy
Applied Mathematics
Archeology
Architecture
Astronomy
Audiology
Bacteriology
Biochemistry
Biology, Biological Sciences
Biophysics
Botany
Chemistry
Dentistry
Earth Science
Engineering
Entomology
Forestry

Code 02 - Natural Sciences (cont.)

Genetics
Geology
Health Sciences
Life Sciences
Mathematics
Medicine
Metallurgy
Microbiology
Mining
Nursing
Nutrition
Occupational Therapy
Oceanography
Optometry
Osteopathy
Parasitology
Pathology
Pharmacology
Pharmacy
Physical Therapy
Physics
Physiology
Premedicine
Public Health
Statistics
Veterinary Medicine
Zoology

Code 03 - Social Sciences

Afro-American History
American Civilization, American Studies
American History
Anthropology
Communications
Economics
European History
Geography
Government
History
Industrial Relations and Personnel

Table 1 (cont.)

Code 03 - Social Sciences

International Relations
Latin American History
Law
Other Social Science
Political Science
Prelaw
Psychology
Public Administration
Slavic Studies
Social Psychology
Social Studies
Social Work
Sociology
Urban Development (Regional Planning)

Code 04 - Elementary Education

Early Childhood
Middle School
Nursery School
Primary School

Code 05 - Practical Arts & Science

Agriculture
Child Care
Computer Science
Cooking
Distributive Education
Drafting
Electronics
Food Service

Code 05 - Practical Arts & Science (cont.)

Home Economics
Industrial Arts
Metal
Plastics
Printing
Sewing
Trade and Industrial Education
Wood

Code 06 - Business

Accounting
Administration
Bookkeeping
Data Processing
Distributive Education
Economics
Management
Shorthand
Typing

Code 07 - Education-General

Administration and Supervision
Education Psychology
Guidance and Counseling
Library Media Specialist
Physical Education
Reading Specialist
School Psychology
Special Education
Tests and Measurements

2. Social Science majors would score highest in social studies;
3. Natural Science majors (which includes math majors) would score highest in mathematics;
4. Natural Science majors would also score highest in science.

Procedure

The initial analysis, using general linear models, tests whatever undergraduate major predicts performance on the four sections of the Test of General Knowledge, as hypothesized above. Tukey post hoc contrasts were employed to determine the significance of pairwise comparisons of the means attained by examinees grouped by major in each of the four test sections. In Tables 4-7, significant differences among these means are indicated through the use of roman numerals. Means that are associated with the same roman numerals are not significantly different, while those that do not share the same roman numerals are significantly different.

These analyses are limited by lack of control over different reasons for taking the test, for examinees with different majors. For example, we would expect that among education majors, a wider spectrum of ability in General Knowledge would be sampled than among non-education majors, since in many states, education majors must pass the Test of General Knowledge to become certified to teach. This factor would interact with whether non-education majors could be certified in the state where the test is administered. Even within states that use the test as a criterion for alternate route certification, there may be different attractions for math majors to seek teacher certification, for example, than for business majors.

To control for the skills of the examinees, a second set of analyses were performed, in which undergraduate grade point average was treated as a covariate, under the assumption that examinees that are more skilled in general knowledge would achieve higher undergraduate grade point averages.[1] Grade point average is collected in five categories on the answer sheets. For the analyses, groups were collapsed as less than 2.5, 2.5-2.99, 3.0-3.49, 3.5 and above. Tables 2 and 3 present the numbers of examinees for each major and grade point average grouping.

Results and Discussion

The highest scores on the subsections of the Test of General Knowledge were achieved by examinees with undergraduate majors that would logically prepare them better. The hypotheses are all supported in both sets of analyses. These findings provide evidence that performance on the different sections of the Test of General Knowledge is related to undergraduate major. Several likely explanations for this are:

a) Undergraduate major is selected by students who are better skilled in the area, and the Test is sensitive to skill differences;

b) Students of different majors have greater exposure to the subject matter, and therefore score differently; and/or

c) Differential interest in the subject matter is related to both choice of undergraduate major and higher test scores.

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[1] The assumption is made here that grade point average has roughly the same interpretation for different majors. The gross classes of averages used in the analyses, while not supporting this assumption, are intended to limit the variation in meaning of grade point average, from major to major.

Recent analyses show that, after controlling for grade point average, college grade level was not related to General Knowledge scores. In these analyses, sophomore and freshmen students were collapsed into one group to increase the number of scores analyzed. Therefore, if explanation b is correct, perhaps the differential exposure comes before the junior year in college.

If any of the explanations is correct, support is given to the sensitivity of the four sections of the test to differences in the preparedness and/or interest of the examinees. This, in turn, supports the contruct validity of the instrument.

Table 2

Number and Percentage of Examinees by
Undergraduate Grade Point Average and
Major, October 1986 National Administration

Major		Grade Point Average				Total
		0-2.49	2.50-2.99	3.00-3.49	3.50-4.00	
1. Humanities	N	115	588	979	657	2,339
	%	5.04	25.11	41.80	28.05	100.00
2. Natural Sciences	N	122	526	718	374	1,740
	%	7.01	30.23	41.26	21.49	100.00
3. Social Sciences	N	145	577	780	375	1,740
	%	7.73	30.74	41.56	19.98	100.00
4. Elementary Education	N	563	1,996	2,353	1,286	6,198
	%	9.09	32.22	37.99	20.70	100.00
5. Practical Arts and Science	N	47	174	182	63	466
	%	10.09	37.34	39.06	13.52	100.00
6. Business	N	58	199	183	106	546
	%	10.62	36.45	33.52	19.41	100.00
7. General Education	N	220	703	672	312	1,907
	%	11.54	36.86	35.24	16.36	100.00
8. Other	N	19	72	102	56	249
	%	7.63	28.92	40.96	22.49	100.00
9. Unknown	N	14	33	34	13	94
	%	14.89	35.11	36.17	13.83	100.00
Total	N	1,303	4,868	6,003	3,242	15,416
	%	8.47	31.58	38.94	21.01	100.00

Table 3

Number and Percentage of Examinees by Undergraduate Grade Point Average and Major, March 1987 National Administration

Major		Grade Point Average				Total
		0-2.49	2.50-2.99	3.00-3.49	3.50-4.00	
1. Humanities	N	109	721	1,438	905	3,173
	%	3.44	22.72	45.32	28.52	100.00
2. Natural Sciences	N	123	701	984	570	2,378
	%	5.17	29.48	41.38	23.97	100.00
3. Social Sciences	N	165	751	1,012	569	2,497
	%	6.61	30.08	40.53	22.79	100.00
4. Elementary Education	N	587	2,386	3,191	1,783	7,947
	%	9.09	32.22	37.99	20.70	100.00
5. Practical Arts and Science	N	57	211	228	99	595
	%	9.58	35.46	38.32	16.64	100.00
6. Business	N	60	216	279	113	668
	%	8.98	32.34	41.77	16.92	100.00
7. General Education	N	240	887	891	396	2,414
	%	9.94	36.74	36.91	16.40	100.00
8. Other	N	18	89	119	54	280
	%	6.43	31.79	42.50	19.29	100.00
9. Unknown	N	20	68	60	36	184
	%	10.87	76.96	32.61	19.57	100.00
Total	N	1,379	6,030	8,202	4,525	20,136
	%	6.85	29.95	40.73	22.47	100.00

Table 4

Mean Raw Section Totals on the
Test of General Knowledge, By
Undergraduate Major, October 1986

Undergraduate		Literature & Fine Arts		Math		Science		Social Studies	
Major	N	Mean	Grouping[1]	Mean	Grouping[1]	Mean	Grouping[1]	Mean	Grouping[1]
Humanities	2,488	21.98	I	18.08	II	19.75	II, III	18.55	II
Nat. Sciences	1,820	20.88	II	20.58	I	21.67	I	18.53	II
Social Sciences	2,031	20.81	II	18.30	II	20.05	II	19.31	I
Elem. Education	6,550	18.62	IV, V	16.10	IV	17.88	IV	15.80	V
Pract. Arts & Sci.	490	18.91	IV	18.13	II	19.77	II, III	17.12	III, IV
Business	567	18.58	IV, V	18.04	II	18.16	IV	16.76	IV
General Ed.	1,978	18.02	V, VI	16.27	IV, V	17.90	IV	15.57	V
Others	271	20.11	III	17.41	III	19.32	III	16.46	III
Unknown	107	17.56	VI	15.71	V	17.64	IV	16.10	V
Total	16,302	19.61		17.58		18.95		17.03	
S		5.03		4.75		4.57		4.26	

[1] Means not sharing the same Roman numeral grouping are significantly different.

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Table 5

Mean Raw Section Totals on the
Test of General Knowledge, By
Undergraduate Major, March 1987

Undergraduate		Literature & Fine Arts		Math		Science		Social Studies	
Major	N	Mean	Grouping[1]	Mean	Grouping[1]	Mean	Grouping[1]	Mean	Grouping[1]
Humanities	3,407	23.33	I	17.31	II	19.63	II	20.29	II
Nat. Sciences	2,504	22.39	II	20.17	I	21.15	I	20.74	I
Social Sciences	2,670	22.31	II	17.29	II	19.47	II	20.90	I
Elem. Education	8,460	20.11	IV	15.69	IV	17.49	V	17.46	IV
Pract. Arts & Sci.	634	20.26	IV	17.00	II, III	18.80	III	17.46	IV
Business	704	20.03	IV	17.35	II	18.05	IV	18.59	III
General Ed.	2,524	19.32	V	15.52	IV	17.19	V, VI	17.17	IV
Others	301	21.48	III	16.57	III	19.03	III	19.07	III
Unknown	194	19.01	V	14.29	V	16.91	VI	17.06	IV
Total	21,398	21.08		16.74		18.55		18.79	
S		4.93		4.94		4.28		4.62	

[1] Means not sharing the same Roman numeral grouping are significantly different.

Table 6

Means for Various Undergraduate Majors on Sections
of the Test of General Knowledge, October 1986
National Administration, Adjusted for Grade Point Average

	TEST SECTION							
	Literature & Fine Arts		Math		Science		Social Studies	
Major	Adjusted Mean	Grouping[1]	Adjusted Mean	Grouping	Adjusted Mean	Grouping	Adjusted Mean	Grouping
1. Humanities	21.63	I	17.88	III, IV	19.54	III	18.29	II
2. Natural Sciences	20.82	II	20.55	I	21.62	I	18.47	II
3. Social Sciences	20.80	II	18.33	II	20.06	II	19.28	I
4. Elementary Education	18.69	III	16.80	V	17.92	V	15.83	VI
5. Practical Arts and Science	19.19	IV	18.45	II	19.99	II	17.38	III
6. Business	18.78	III, IV	18.20	II, III	18.28	IV	16.96	IV, V
7. General Education	18.28	V	16.53	VI	18.09	IV, V	15.75	VI
8. Other	20.09	VI	17.49	IV	19.27	III	17.40	III, IV
9. Unknown	18.07	III, V	16.09	V, VI	17.96	IV, V	16.48	V, VI
Total	19.62		17.65		18.96		16.03	
S	5.01		4.72		4.17		4.25	

[1]Planned comparisons; means not sharing the same Roman numeral grouping are significantly different.

Table 7

Means for Various Undergraduate Majors on Sections
of the Test of General Knowledge, March 1987
National Administration, Adjusted for Grade Point Average

	TEST SECTION							
	Literature & Fine Arts		Math		Science		Social Studies	
Major	Adjusted Mean	Grouping[1]	Adjusted Mean	Grouping	Adjusted Mean	Grouping	Adjusted Mean	Grouping
1. Humanities	23.01	I	16.13	III, IV	19.36	II	20.05	II
2. Natural Sciences	22.36	II	20.16	I	21.09	I	20.70	I
3. Social Sciences	22.32	II	17.37	II, III	19.51	II	20.93	I
4. Elementary Education	20.15	V	15.80	V	17.55	V	17.49	IV
5. Practical Arts and Science	20.54	IV	17.29	II, III, IV	18.98	III	19.08	III
6. Business	20.27	IV, V	17.60	II	18.24	IV	18.79	III
7. General Education	19.62	VI	15.83	V	17.46	V	17.46	IV
8. Other	21.61	III	16.72	IV	19.16	II, III	19.16	III
9. Unknown	19.29	VI	14.58	VI	17.17	V	17.30	IV
Total	21.10		16.83		18.57		18.81	
S	4.91		4.91		4.27		4.60	

[1] Planned comparisons; Means not sharing the same roman numeral grouping are significantly different.

APPENDIX A

ANOVA Summary Tables:
Section Totals on the test of
General Knowledge, by
Undergraduate Major,
October 1986 National Administration

Section	Variable	Sum of Squares	Degrees of Freedom	Mean Square	F-Ratio
Literature and Fire Arts	Major	32705.10	8	4088.14	175.70***
	Error	379090.97	16293	23.27	
	Total	411796.07	16301		
Math	Major	27240.97	8	3405.12	162.69***
	Error	341006.55	16293	20.93	
	Total	368247.52	16301		
Science	Major	28006.71	8	3500.84	223.39***
	Error	255339.00	16293	15.67	
	Total	283345.72	16301		
Social Studies	Major	34809.70	8	4351.21	271.78
	Error	260851.44	16293	16.01	
	Total	295661.14	16301		

*Exceeds the $p < .05$ level of significance.
**Exceeds the $p < .01$ level of significance.
***Exceeds the $p < .001$ level of significance.

APPENDIX A

ANOVA Summary Tables:
Section Totals on the test of
General Knowledge, by
Undergraduate Major,
March 1987 National Administration

Section	Variable	Sum of Squares	Degrees of Freedom	Mean Square	F-Ratio
Literature and Fire Arts	Major	43532.47	8	5441.56	243.73***
	Error	477536.12	21389	22.33	
	Total	521068.58	21397		
Math	Major	45960.65	8	5745.08	257.48***
	Error	477252.42	21389	22.31	
	Total	523213.07	21397		
Science	Major	38058.80	8	4757.35	287.71***
	Error	353670.36	21389	16.54	
	Total	391729.17	21397		
Social Studies	Major	51332.72	8	6416.59	338.37
	Error	405609.54	21389	18.96	
	Total	456942.26	21397		

*Exceeds the $p < .05$ level of significance.
**Exceeds the $p < .01$ level of significance.
***Exceeds the $p < .001$ level of significance.

APPENDIX B

ANCOVA Summary Tables: Section Totals on the Test of General Knowledge, by Undergraduate Major, Adjusted for Undergraduate Grade Point Average, October 1986 National Administration

Section	Variable	Sum of Squares	Degrees of Freedom	Mean Square	F-Ratio
Literature and Fine Arts	Major	23954.32	8	2994.29	141.53***
	GPA	30308.57	1	30308.59	
	Error	325911.06	15405	21.16	
	Total	386444.40	15414		
Math	Major	23166.06	8	2895.76	149.08***
	GPA	18979.15	1	18979.15	
	Error	299220.92	15405	19.42	
	Total	343623.23	15414		
Science	Major	24290.19	8	3036.27	208.03***
	GPA	15884.22	1	15884.22	
	Error	224845.26	15405		
	Total	267449.85	15414		
Social Studies	Major	28923.77	8	3615.47	244.23***
	GPA	17472.82	1	17472.82	
	Error	228044.38	15405		
	Total	278068.23	15414		

***Exceeds the $p < .001$ level of significance.

APPENDIX B

ANCOVA Summary Tables: Section Totals on the Test of General Knowledge, by Undergraduate Major, Adjusted for Undergraduate Grade Point Average, March 1987 National Administration

Section	Variable	Sum of Squares	Degrees of Freedom	Mean Square	F-Ratio
Literature and Fine Arts	Major	32482.10	8	4060.26	198.66***
	GPA	33542.42	1	33542.42	
	Error	411334.48	20126	20.44	
	Total	485341.40	20135		
Math	Major	39566.40	8	4945.80	237.83***
	GPA	24549.00	1	24549.00	
	Error	418537.80	20126	20.80	
	Total	486109.37	20135		
Science	Major	30996.22	8	3874.53	253.78***
	GPA	24046.19	1	24046.19	
	Error	307270.84	20126	15.27	
	Total	366596.14	20135		
Social Studies	Major	43098.66	8	5387.33	306.02***
	GPA	24195.50	1	24195.50	
	Error	354305.10	20126	17.60	
	Total	426892.05	20135		

***Exceeds the $p < .01$ level of significance.